

PHOTOGRAPHY

IN

FOUR LESSONS:

A

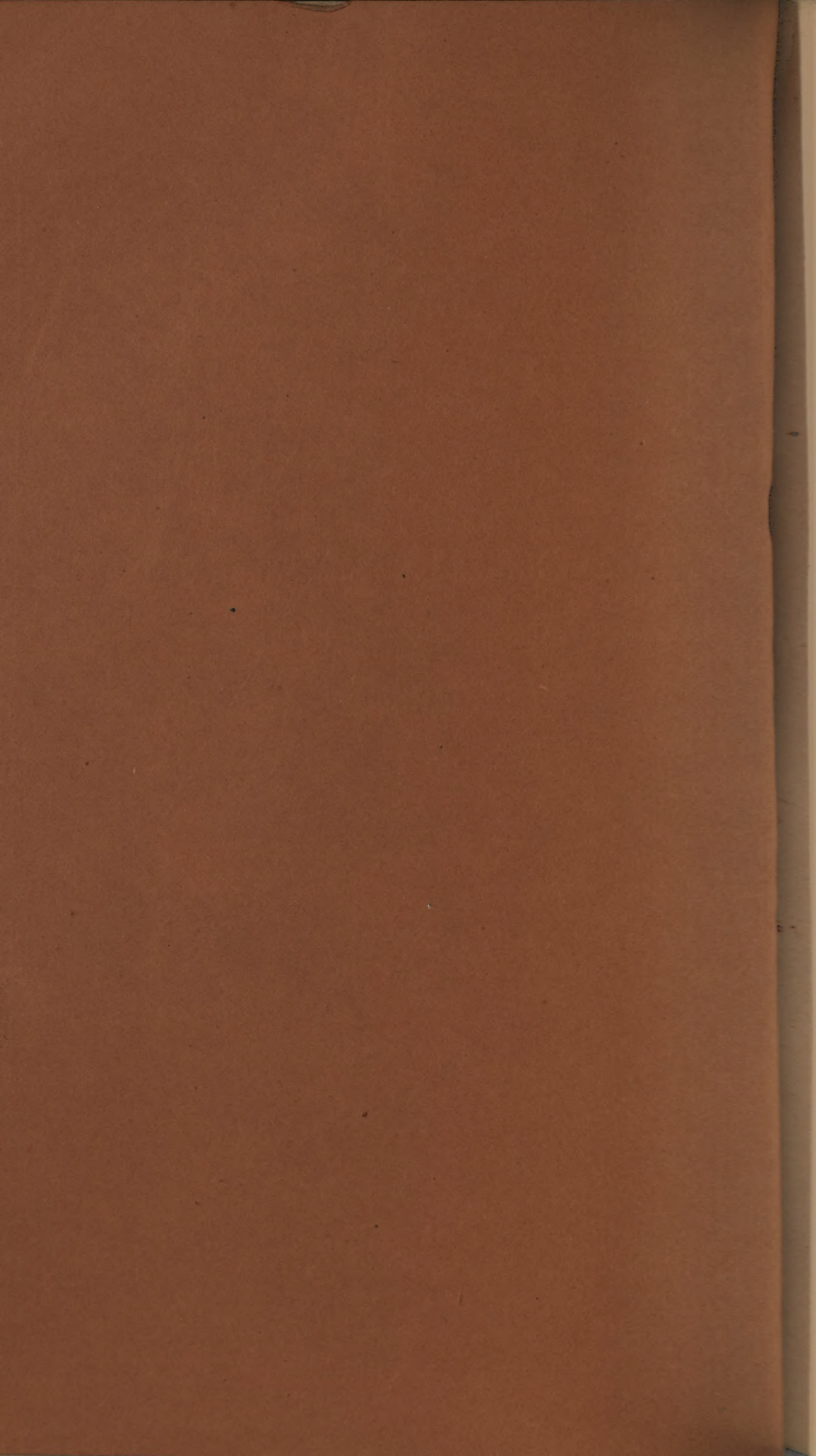
BOOK FOR BEGINNERS AND ADVANCED STUDENTS

- I.—HOW TO TAKE POSITIVES ON GLASS.
- II.—HOW TO TAKE NEGATIVES.
- III.—HOW TO PRINT POSITIVES ON PAPER.
- IV.—HOW TO PRODUCE LARGE PHOTOGRAPHS
FROM SMALL ONES.

LONDON:

J. SOLOMON, PHOTOGRAPHIC WAREHOUSE,
22, RED LION SQUARE.

PRICE ONE SHILLING.



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FOUR LESSONS

FOR THE STUDENT AND THE WORKMAN

LONDON:
PIPER AND CARTER, PRINTERS, GOUGH SQUARE, E.C.

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INTRODUCTION.

THIS is chiefly a book for beginners. It does not deal with the history of photography, nor its theoretical principles, nor its manufacturing chemistry. The beginner will purchase his apparatus and materials ready made; mix his preparations as we shall direct, and use them as we shall instruct him, his sole object at present being to take pictures. When he has accomplished this he will begin to inquire upon what principles the art is based, and make some practical experiments in its chemistry. But he will begin by learning the practice. A man learns to talk before he studies grammar.

One or two preliminary explanations only are necessary. The student probably knows that the light of the sun is one of the chief agents in producing photographs. White light is composed of the three rays, the blue, the red, and the yellow rays. It is the blue ray which is chiefly active in photography.

This enables us to work in a room where there is only yellow light, and make all the preparations which are acted upon by the blue rays, without any injury to them. If this were not the case, many of the operations of the photographer would have to be carried on in perfect darkness, as the student will soon see.

It is necessary next to explain the terms *positive* and *negative*. A positive is in all cases the ultimate object of the photographer: it is a picture which can be examined and understood by everybody. A negative is not a picture in itself, but a plate from which, by the agency of light, positive pictures can be printed, bearing, in fact, a similar relation to a positive that an engraved copper-plate does to the print from it. Having made these brief explanations, we shall now go to work.

LESSON FIRST.

TO TAKE COLLODION POSITIVES.

BEGIN by getting an equipment of apparatus and materials with which to work. It is not necessary to begin with an extensive stock, and an honest dealer will aid you in making a suitable selection. We will mention a few of the articles are which absolutely necessary. A camera and lens ; a camera-stand ; a dipping-bath for the nitrate of silver solution, and a dipper ; a few dishes ; two or three glass measures ; two or three funnels ; scales and weights ; glass plates of various sizes ; pure nitrate of silver ; positive collodion ; protosulphate of iron ; acetic acid ; cyanide of potassium ; spirits of wine ; filtering-paper ; black and white varnish, and a few plate-boxes. Subjoined to the final chapter we add a more complete list.

Before commencing operations, arrange a dark room, as it is termed ; but it must not be dark, but illuminated with yellow light. You may manage this in various ways. If you can set aside a small room, or build one for the purpose, it is most convenient ; if not, some other room must be darkened so as to remove all white light. A room which is kept for the purpose should have the window glazed with deep orange glass, the light through which will have no chemical action ; or, it may have its ordinary window covered with a blind of three or four thicknesses of deep yellow glazed calico. Where neither of these modes of securing yellow light is available, a

darkened room lighted with a candle at a little distance from the manipulator may be made to answer the purpose. A lamp with yellow glass is very convenient in this case. We will leave the mode of arranging the interior of the dark room to the convenience of each student, merely remarking that if it have a supply of water and a sink, it will be a great convenience.

Now make your solutions thus :

Silver Bath :—

Pure crystallized nitrate of silver	...	1 ounce
Distilled water	... ..	16 ounces

When this is dissolved and filtered, place it in the dipping-bath. Now coat a plate with collodion, and immerse it in the bath, leaving it there for an hour or two, and then repeat the operation with another plate. This is iodizing the bath.

Developing Solution :—

Protosulphate of iron...	...	20 grains
Glacial acetic acid	...	20 minims
Nitric acid	...	2 „
Alcohol	...	20 „
Water	...	1 ounce

Fixing Solution :—

Cyanide of potassium ..	...	10 grains
Water ...	...	1 ounce

To Clean a Plate.—Take a little tripoli and spirits of wine mixed to the consistency of thick cream, and rub carefully all over both sides with a piece of cotton-wool. Then take a little spirits of wine alone, and a fresh clean piece of cotton wool, and finish the plate. If the glass have been used before, it will require the addition of a little nitric acid to the cleaning preparation.

The diamond polish sold by J. Solomon for the last

twelve years is the cheapest and best medium for cleaning glass, and is used by the majority of photographers, amateur and professional.

Let the student, however, get this fact firmly impressed upon his mind, that one of the most important duties he undertakes is the cleaning of his glass plates. A plate chemically clean is absolutely imperative, in order to secure success. When the plate is cleaned, breathe upon it; if it be quite clean, the breath will leave it evenly, without showing irregular markings. If streaks or spots of any kind are developed by the breath, the plate must be cleaned again.

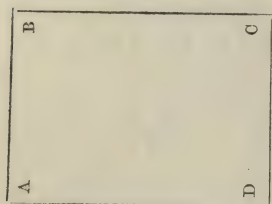
All cloths used for cleaning plates should be washed without the use of soap. They may be boiled with some common washing soda, and then rinsed in plentiful changes of water.

There are holders made in which the plate is held during the operation of cleaning; one of which the student is recommended to obtain.

Coating the Plate with Collodion.—Collodion is a solution of gun-cotton in ether and alcohol. When poured on a glass plate, it spreads in a thin film, something like a varnish, setting in a minute or two. It contains, when used for photography, certain iodides and bromides, which combine with the silver in the nitrate of silver bath, to form a film sensitive to the action of light. The beginner will generally purchase his collodion ready prepared; it is therefore unnecessary to enter into a description of the mode of preparing it here.

When the cleaned plate is ready for coating, give it a final brush with a flat camel-hair brush, to remove the last traces of dust, and, holding it by the top right-hand corner in the left hand, pour some collodion in the middle, until about half the plate appears covered. Now incline the plate so that the collodion runs towards the thumb where it holds the plate, but

take care it does not touch; then incline the plate until the collodion runs to the top corner opposite the thumb; there let it flow to the bottom of the plate, at the bottom left-hand corner, and finally pour any excess off the bottom right-hand corner into the bottle. This must be done with moderate rapidity, so that the collodion may not begin to set until the plate is perfectly covered. To explain more clearly, let the following diagram be the plate:—



It will be held with the finger and thumb of the left hand at A, the thumb covering the smallest possible portion of the surface. The collodion is first inclined to corner A, next to corner B, then to C, and finally poured off at D. When the film is sufficiently set, which will be in from half-a-minute to a minute, it is to be placed with its end resting on the ledge of the *dipper*, and lowered with a steady movement, without pause, into the nitrate of silver solution, which is kept in an oblong vertical vessel termed the bath. Experience alone will teach the student when the film is sufficiently set for immersion; but he may ascertain by touching one corner, and if it receive the impression of his finger without being smeared or adhering, it is generally sufficiently set.

The bath, the student will remember, is in the dark room, and all the operations now, except exposure, will be performed in the same place. The plate will remain in the solution about three minutes, during which time it will be moved up and down once or twice, to facilitate the evaporation of the ether, and aid the silver solution in permeating freely. The iodide and bromide in the collodion become, in virtue of a chemical reaction not necessary to trouble the student with here, iodide and bromide of silver, and the film, which was before transparent,

is now creamy looking. If the solution runs off in an even sheet, the plate is ready; but if it flow in greasy lines and rivulets, it must be returned to the bath a short time.

When the plate is ready, let it drain for a short time, resting on the dipper, and then further drain for a short time, resting on a piece of blotting-paper. Now place it in its proper place in the *dark slide* or *camera back*. It is placed face downwards, its corners resting on the supports provided for it.

Exposing the Plate.—The camera has in the meantime been arranged and focussed in front of the object to be taken, whether a landscape or a portrait. We will suppose it is a portrait. The camera is placed about eight feet from the sitter, and its sliding body drawn out until the image appears tolerably clear on the ground glass. The exact focus is then obtained by means of the rack-and-pinion attached to the lens. It is customary to focus for the eyes, turning the pinion backwards and forwards until the eyes appear perfectly sharp and distinct. If the figure be required on a larger scale, move the camera nearer to the sitter, and pull out the sliding body further; if it be required on a smaller scale, remove the camera further away, and push the sliding body further in.

When the plate is ready and all prepared, remove the ground glass, and put the dark slide in its place in such a position that the sensitive film will be towards the lens. Now pull up the sliding door which covers the plate, then remove the cap which has been placed on the lens, and the plate is exposed so as to receive the image which before fell on the ground glass. The time of exposure will vary with the nature of the subject and the quality of the light. We will suppose, in the case of the portrait in hand, that fifteen seconds will be sufficient. In that time replace the cap on the lens, push down the sliding door, and take the back into the dark room.

Developing the Plate.—Now take the plate in the hand, and hold it as when coating with collodion. A portion of the developing solution, having been poured into a glass cup provided for the purpose, is now thrown over the collodion surface with a dexterous movement, so as to cause the solution to flow over the plate in one wave without stopping. When the exposed plate is brought from the camera and examined in the dark room, no change whatever is apparent to the eye; but when the developing solution is applied the image quickly starts out. As soon as it begins to appear pretty clearly, wash off the developing solution very thoroughly with plenty of water. Experience alone will enable the student to judge when he has carried the development far enough.

Fixing the Picture.—Now pour over the plate a portion of the *fixing solution*, which will quickly dissolve and remove the yellow iodide of silver which has been acted upon by light. As soon as the last trace of this has disappeared, wash carefully and quickly, as the fixing solution, if kept on the plate too long, may injure the image.

The picture is now to be dried and finished. It will be seen that the lights, which are white, consist of reduced silver; and the shadows, which should be dark, are simply transparent.

If the picture be laid upon a piece of black velvet, or if it be covered at the back with a black varnish, the shadows at once assume their proper appearance. Either of these means of backing the picture may be adopted. The collodion film now requires protecting with a white transparent varnish sold for the purpose, and it is then put up in the case or frame in which it is to be kept, a great variety of which are kept on hand by the publisher of these pages.

Tinting the Pictures.—Portraits by the collodion positive process often look a little ghastly unless they are tinted. This

is effected by colours prepared for the purpose, in the form of a fine powder. Almost every variety of tint is provided ready for use. There are several qualities of these colours; those of M. Mansion are very excellent in quality. They are applied by means of camel-hair or sable pencils made for the purpose. Begin by applying a delicate flesh tint to the highest lights on the face; then apply a little deeper flesh tint to the half shadows, touching very lightly, or not at all, upon the deepest shadows of the face. Next tint the hair if necessary, and then the draperies. Now varnish the picture, and proceed to colour again as before, this time applying all the tints of the depth they are required in the finished picture. A little of the proper colour will of course be applied to the lips and cheeks. Jewellery, &c., may be touched with water colours or the gold shell. Fuller particulars on tinting may be found in an excellent little work, entitled "*Harmonious Colouring applied to Photographs.*"

FAILURES IN COLLODION POSITIVES, AND THEIR CAUSES.

The student must be prepared for the failures and imperfections with which he will meet. Care, patience, and perseverance will aid him to overcome them. The following hints will guide him in determining their causes.

Fog, or a Grey Veil over the Shadows.—The term *fog* in photography is used to denote a deposit all over the plate, chiefly obscuring the shadows, but always more or less spoiling the picture. It may proceed from various causes. One of the most common causes is the condition of the nitrate bath, which may become contaminated in various ways. An excellent plan with a nitrate bath which is out of order, is to add a little carbonate of soda, just sufficient to cause a slight precipitate which is not redissolved by shaking the solution, and then

place the bottle containing it in the sun for a few hours. This will cause a black precipitate, which must be filtered out, and the proper amount of nitric acid added to the solution, when it will generally be found to work well. Sometimes the want of sufficient nitric acid will cause fog, in which case the remedy is simple. From one drop to two drops in each ounce of solution will be found ample. Fog may proceed from diffused light in the dark room or in the camera, or sometimes from the use of a very new collodion; and sometimes from other minor causes, which the student will discover by experience.

Stains and Markings of Various Kinds.—Almost all stains and markings proceed from imperfect manipulation. A straight line across the plate probably arises from making a pause whilst immersing the plate in the nitrate bath. Curved lines generally proceed from a check of some kind, causing the developing solution to flow irregularly instead of covering the plate at once in one even wave. Opaque stains at the corner of the plate proceed from allowing the nitrate of silver drainings to accumulate on the supports on which the plates rest. A clean piece of blotting-paper placed upon them each time will often prevent this. Dirty plates will cause all kinds of stains. Dirty fingers for holding the plate whilst developing will often cause stains. Blue stains will sometimes appear whilst fixing; this is caused by not thoroughly washing away the developing solution before applying the fixing solution. Streaks in the direction of the dip may proceed from a scum at the surface of the silver solution, or from the solution being old and in bad order. Opaque or transparent spots often occur from the collodion not being good, or being too new. They also occur from the solution being turbid, and requiring filtering. Irregular marks will occur from the developing solution running back from the edges of the plate in greasy lines. More alcohol in the developer is the remedy.

If the plate be kept out of the bath till the collodion is too dry, a transparent mark will appear at the driest end. If it be put in too soon, a stain will be caused where the film is not set. Bad collodion will crack and reticulate when the picture is finished. Long use will make the collodion thick from evaporation of the ether, and give an uneven film; in which case add a little ether.

Under-Exposure.—The student will discover when the plate has received too little exposure in the camera by the picture appearing too dark generally, but especially in the shadows, which are black and without any detail.

Under-Development will sometimes produce very similar results to under-exposure, but a little observation will enable the student to distinguish between the two.

Over-Exposure.—When the plate is too long exposed in the camera, there is a loss of contrast; those parts which should appear black in the finished picture are light-coloured, and the light parts, such as the face, have no detail, but appear flat and feeble.

Over-Development produces a similar result, with the difference that in this case there is frequently a sparkling deposit of metallic silver.

There are some other defects which the photographer may at times meet with, which care and experience alone will enable him to avoid.

LESSON SECOND.

TO TAKE COLLODION NEGATIVES.

ALMOST all the materials and apparatus used for positives will serve in taking negatives; a few additional articles will be required, which we will refer to as we proceed.

We must first explain the nature and purpose of a negative. It is not a picture perfect in itself, as is the collodion positive, but is a means of producing pictures on paper. It serves a similar purpose to an engraving on a plate of copper or block of wood, from which many prints may be obtained. But the photographic negative is used to print by the agency of light. We will explain how.

If a piece of common writing-paper be placed in a solution of common salt (which is chloride of sodium), and, when it is dry, floated on a solution of nitrate of silver, chloride of silver will be formed in and on the paper. Chloride of silver is easily blackened by the light, and so if the paper be placed in the light it will all turn black. If, on placing it in the light, you lay a key upon it, the shape of the key will be found in white, because that part has been covered up and protected from the action of light. If you place a piece of lace or a fern leaf on the paper, the pattern will be found in white, whilst all the rest will be darkened by light. And if the paper be then placed in a fixing solution, to remove the chloride of silver from the white parts, a picture of the lace or fern is obtained which does not change any further in the light.

Now in their case the lace or fern acts as a negative. The negative is a picture in which the lights and shadows are represented by different degree of transparency. If you look through one of the positives you will see the shadows are quite transparent, and so the black varnish you placed at the back is seen through; the face and the white parts are sufficiently opaque to prevent the black showing through, the whitest part or highest light being most opaque. This, so far as it goes, is just what a negative should be; but in the positive no part is quite opaque enough for a negative. The negative should have some parts—such as the highest lights on the face or white draperies—quite opaque, and the other portions varying in degree of semi-transparency down to the deepest shadows, which should be quite transparent.

Obtain some negative collodion, and then proceed to make a nitrate of silver bath for negatives in the same way as for positives, only with much less acid in it. In fact, the best pictures are obtained with a nitrate bath without any acid, but quite neutral. The beginner may, however, work with a bath containing one drop of nitric acid in about six ounces of solution, because it is easier to get clean pictures in an acid bath.

Proceed to clean the plate, which for negatives should always be plate glass, as before directed. A preliminary coating of dilute albumen made by beating up the white of one egg with a pint of water, and adding a drachm of acetic acid, is found an effective means of securing clean plates. This may be applied to the plate with a brush made by tying a piece of swan's-down calico over the end of a broad strip of glass, and after the preliminary coating setting the plates on edge to dry, and store them away for use. Coat and immerse the plate in the nitrate bath as directed for positives; but for a negative leave it a little longer there. Prepare the camera, and expose as

before directed, but let the time be about twice, or sometimes three times, as long as for a positive.

The development for a negative varies from the development of a positive in two or three points. In the first place it is continued much longer, so as to get every detail impressed by light very distinctly brought out. There should be no nitric acid in the negative developer, only acetic acid. There are two or three preparations for developing negatives. They may be either developed with protosulphate of iron, the same as the positive; or with pyrogallic acid; or with a combination of the two, which is the most usual plan. The iron negative developer may vary in strength, but the following is very convenient:—

Protosulphate of iron	...	...	15 grains
Glacial acetic acid	...	...	15 minims
Water	...	...	1 ounce

The application of this solution, which we will call No. 1, is often alone sufficient to produce a good negative.

The following solution of pyrogallic acid is preferred by some as a developer. As it is sometimes used after the former, we will call it No 2:—

Pyrogallic acid	...	...	2 grains
Citric acid	...	...	1 grain
Water	...	...	1 ounce.

This solution often gives very good negatives when used as a developer, but the plate generally requires a longer exposure than with No. 1.

It sometimes happens that when No. 1 has been applied, and the development has been continued as long as any additional detail or intensity appeared to accumulate, there is still not

sufficient density or opacity in the high lights to make a satisfactory printing negative. If this be the case, then wash the plate very carefully, and take about half an ounce of No. 2, and add to it about eight or ten drops of a 20-grain solution of nitrate of silver to be kept for the purpose. Now apply this to the plate for the purpose of intensifying it. The lights will quickly be seen to become much denser and more opaque. This can be applied, pouring it off and on, until the proper intensity is obtained. The negative is then to be washed and fixed.

A method of developing which is found to possess many advantages has been introduced by Mr. B. J. Edwards. As the solution is kept ready for use, and admits of considerable variation to suit different kinds of work, we append it here as described by the originator in the *Year-Book of Photography* for 1872. A saturated solution is first made as follows :—

“Take one pound of the double salt of iron and ammonia, with about one ounce of sulphate of copper. Throw them together into a large jar, and add water (about forty ounces) to form a saturated solution; after agitating until no more of the salts will dissolve, allow the mixture to settle, when it will be perfectly bright and clear, and of an apple-green colour. This colour it will retain for any length of time, together with all its properties, as when freshly mixed. I have kept it many months, and have never known it to become discoloured, as is the case with a plain saturated solution of sulphate of iron.

When required for use take, by measure—

Iron and copper solution	...	...	4 drachms
Glacial acetic acid	...	...	4 „
Alcohol	...	...	4 „
Water...	...	...	8 ounces

This will make a capital developer for summer use. For quick pictures, or winter work, the formula will be—

Iron solution	...	...	...	...	1 ounce
Glacial acetic acid	...	...	...	...	1 drachm
Alcohol...	...	...	...	...	4 drachms
Water	...	...	...	...	8 ounces

For instantaneous work a still stronger solution may be used with advantage; while for copying engravings, or where strong contrasts are desired, the first formula may be very much diluted.

“It is a good plan to keep each of the above developers ready, and use them either alone or mixed in different proportions as required; by these means the developer may be adjusted in a moment to suit the subject or the exposure. If desired to intensify, which is seldom requisite, a little silver solution may be added to the iron developer; this can readily be done without forming a precipitate; or, if preferred, the plate may be flooded (without washing) with a fresh portion of iron developer without the addition of silver; in many cases, where only a slight degree more vigour is wanted, this will be found the better plan.

“I have hitherto been speaking of portraits, but this form of iron developer will be found not less useful for all kinds of landscape work; there is no danger of fogging the plates, with far less than the usual difficulty in obtaining the right intensity in the negatives, which, at the same time, will possess great delicacy of detail, both in the shadows and high lights. For distant views and cloud effects this developer is invaluable, some of the most delicate effects of distance with clouds being often secured with a fully exposed foreground on the same plate.”

The fixing solution for negatives may be the same as for

positives, but it is better to fix the negative with a saturated solution of hyposulphite of soda. It may be used in a dipping bath the same as the silver solution. It must then be very thoroughly washed.

Should the negative, after it is fixed, be insufficiently dense for producing good prints, it may, after being well washed, be treated again with the No. 2, with a few drops of silver solution as just described, until the bright intensity is obtained. The negative is then to be well washed and dried. There are other modes of intensifying, but these are sufficient for the beginner.

It is a most important point to get the eye educated to know a good negative with requisite gradation and intensity for producing good prints, and to be able to perceive in the process of development and intensifying when the right stage of intensity, &c., is reached. The student is recommended to procure, if possible, a good negative at the outset as a guide or standard. This will materially facilitate his labours and success.

The negative when dry should be coated with a suitable varnish, to protect it from scratches or abrasion during the process of printing. A spirit varnish generally answers best. The plate should be gently warmed, and the varnish poured on in the same way as collodion. The plate must then be held before a gentle heat until the varnish is set properly. It is then ready for printing.

FAILURES IN THE NEGATIVE PROCESS, AND THEIR CAUSES.

Negatives are liable to all the same imperfections as positives, and from the same causes, and also to some other defects.

Fog.—When fog is present in the negative from any cause,

it veils the shadows and makes it impossible to get a rich or brilliant print. The free addition of nitric acid cannot be adopted, as in the positive process, as a means of getting rid of fog; but the solution must be cleared of all impurities. One of the simplest methods of effecting this is as described on a former page, by first adding a little of a solution of bicarbonate of soda until a slight permanent precipitate is formed, and then placing the solution in sunlight for a few hours, or even days. The black deposit must be removed by filtration, and the bath will then probably work well without further addition. From one-eighth of a drop to one-fourth of a drop of nitric acid may be added if necessary to each ounce of solution. Sometimes the shadows will be slightly fogged from the use of too strong an iron developer; sometimes from the want of sufficient acetic acid in the developer; sometimes from over-development with the iron solution; sometimes from direct sunlight entering the camera through the lens; and sometimes from other special causes which experience will point out. N.B.—When pyrogallic acid is used for development, acetic acid should be used in the nitrate bath in place of nitric acid; about one drop of acid to each ounce of solution.

Under-Exposure will often produce a grey, fogged, imperfect image. Sometimes it will produce an image of apparently great brilliancy, being very dense in the lights, but without detail in the shadows; the prints from such a negative would be simply black and white, without any softness, detail, or modelling.

Over-Exposure will produce want of contrast, the shadows will leave a deposit all over, and the lights will not possess a proportionate intensity. The picture will lack contrast and vigour; but over-exposure is better than under-exposure.

All the sources of failure described as occurring with collodion positives may occur with negatives, as well as some others. In fixing with hyposulphite of soda great care is necessary to wash thoroughly, otherwise traces of this salt will remain in the film, which will subsequently injure the negative. When the process of intensifying requires a long application of the solutions, a red, foggy, deposit on the shadows will sometimes occur. The remedy is, in the first place, to have everything very clean, and when the tendency is present, to add more citric acid to the pyrogallie acid solution. A solution of tincture of iodine in water of almost the colour of brown sherry, poured over the film, allowed to remain a few minutes, and then washed off before the application of the pyrogallie acid and silver, is also a remedy. The film will sometimes become loose, and show a tendency to leave the glass. Remedy: very carefully cleaned plates; letting the collodion set well before immersion in the nitrate bath; roughing the edge of the plates, or the use of a more adherent sample of collodion. Sometimes it is difficult to obtain sufficient density in the negative. There are various modes of obtaining intensity in such cases; but the beginner had better try another sample of collodion. Too much nitric acid in the bath, a weak, bad light, and other causes, will induce this trouble. There are some other difficulties, which experience will overcome.

LESSON THIRD.

HOW TO PRODUCE PRINTS ON PAPER.

PHOTOGRAPHIC prints are produced on various kinds of paper, but the student will commence with albumenized paper, to which we shall confine our attention here.

We have explained in the last lesson that paper prepared with chloride of silver will blacken in the sunlight. Albumenized paper is used because it gives a better surface and richer prints than plain paper. A soluble chloride is mixed with the albumen and spread upon the surface of the paper. It is not necessary to explain the mode of preparing it, as the student will always purchase it ready for use.

Commence printing operations by obtaining a stock of albumenized paper, nitrate of silver, chloride of gold, acetate of soda, and hyposulphite of soda. Also four or five flat porcelain dishes for the different solutions. For the beginner, dishes large enough to take pieces of paper about nine inches by seven inches are suitable. A silver meter, two or three glass funnels, filtering paper, two or three printing-frames of different sizes, American clips (or some black pins), will complete the equipment.

SOLUTIONS NECESSARY.

No. 1.—*Exciting Solution*:—

Pure nitrate of silver	...	...	60 grains
Distilled water	...	...	1 ounce

It will be well to make about a quart, or forty ounces, of this solution for convenient use. It should be tested from time to time with the silver meter, as it gets weaker by use; it should never be suffered to get weaker than forty grains of silver to the ounce of water.

No 2.—*Toning Solution* :—

Chloride of gold	...	...	...	3 grains
Acetate of soda	...	...	...	90 „
Distilled water	...	...	...	1 pint

This solution should be made a day or two before use, but it becomes inactive if kept many weeks.

No. 3.—*Fixing Solution* :—

Hyposulphite of soda	...	...	...	4 ounces
Water...	...	...	...	1 pint

This solution should be thrown away each time when it has been used.

MANIPULATIONS.

If a sheet of albumenized paper be cut up into six pieces, doubling it lengthwise, and cutting each half into three, six pieces about nine inches by seven inches are obtained, a convenient size to begin with. Pour into one of the dishes, which must be perfectly clean, sufficient of solution No. 1 to fill the dish from half an inch to an inch deep. Now take one of the pieces of paper by the opposite corners diagonally, and allow it to fall in a curve, so as to touch the solution first at the centre; now lower it quickly, but steadily, so that all the remainder comes into contact with the surface of the solution by one continuous motion without interruption. Allow it to float about three minutes. Raise it by one corner, gently, and

allow it to drain for a minute. Now pin it at one corner with one of the black pins, or fasten it with one of the American clips, to a lath or a stretched cord, to dry.

All this must be done in the dark room, and the paper is now sensitive to light.

When it is dry, take a negative and lay with its face upwards in the printing-frame. Lay a piece of the sensitive paper upon its face; place the back of the printing-frame on the paper, and clamp the whole firmly together. Now place the frame so that the light passes through the negative to the paper. An intense negative with strong contrasts is best printed in the direct sunlight, a feeble one in diffused light. The student will observe that the back of the printing-frame is hinged with a fastening which allows one-half to be kept firm whilst the other half is open. He is thus enabled, without removing the paper, to examine the progress of the printing from time to time, which must be done in the dark room. The time required will depend on the character of the negative and the strength of the light, varying from five minutes to several hours. But as the progress can be examined, not much difficulty will be encountered. The printing, as a general rule, must be carried to a much greater depth than is required in the finished picture, as it loses considerably in the processes it has still to undergo.

A number of prints may be produced and put into a drawer in the dark room in order to be toned altogether, but this should be done, if possible, on the same day as they are printed. When they are all ready, place them in a clean dish, and wash them in three or four changes of water, letting them remain in each five or ten minutes. Distilled or filtered rain water is best for this purpose.

Now place them in sufficient of the toning solution (No. 2) to cover them conveniently, and keep them moving about,

taking care to prevent them sticking together, which would cause irregular toning. In this solution the prints will be seen to become gradually deeper in colour, first becoming purple, and then a bluish black. If taken out when of a purple tint, the finished print will be of a purple brown colour; if it be kept in the solution until it assumes a black tint, the finished print will be of a purple or purple-black tone. When the right colour has been obtained, the prints are removed to another dish of clean water, and after rinsing are placed in the fixing bath of hyposulphite of soda (No. 3).

The prints must remain in the fixing bath not less than a quarter of an hour, the same care being taken to keep them from sticking together as in toning. Unless the fixing solution has free access to every part of the print, it will be imperfectly fixed, which will issue in dirty brown or yellow stains.

The print is removed from the fixing bath into clean water, and washed in repeated changes during the course of a few hours: four or five thorough changes of water in each hour, during the course of six hours, will not be too much to ensure perfect washing from every trace of hyposulphite of soda, any trace of which remaining in the print would be apt to cause fading.

When a number of sheets of paper have been floated upon solution No. 1, it will probably become brown or dark coloured. Until this becomes very deep, it will not injure the picture; but when the colour has become very deep, it may be removed by putting a little kaolin into the bottle containing the solution, and shaking. On subsequent filtration the solution will flow from the filter clear and white.

When solution No. 2 has toned a number of prints, it will become inactive, and must be either replenished with fresh solution, or thrown away, and fresh solution used.

Great care must be used never to touch sensitive paper or unfixed prints with fingers which have been in any kind of contact with hyposulphite of soda, or indelible brown stains will result. Each dish must be kept to its own use, those for the silver solution No. 1, and the hyposulphite solution No. 3, especially.

It is better to prepare the paper and finish the picture all in one day; but if the weather be dry and cold, and everything be kept in the dark, two, or even more days, may elapse between the exciting of the print without great disadvantage.

When the prints are completed and thoroughly washed, they may be dried, and mounted upon cardboard. Common paste or gum should not be used; but a paste freshly made from starch or fresh clean glue answers the purpose best. When dry the print should be calendered by means of a rolling-press, to make it flat and give it a fine surface.

FAILURES IN PRINTING, AND THEIR CAUSES.

Many of the imperfections in prints will be found to be due to defects in the negatives; but, independent of these, there are many causes of failure in the process itself.

A white patch in the print may sometimes occur. This is caused by an air-bubble being under the floating paper on the nitrate bath.

A marbled or mottled effect is due to the nitrate bath being too weak, which it will become through long use without being replenished.

A weak, flat effect, without contrasts, may arise from the use of a weak negative, and also from the use of a weak nitrate bath; it may also arise from insufficient exposure in the printing-

frame. Over-toning will produce a similar result, but the print will always be of a grey slatey tint in such case.

Prints too dark or too black.—Over-printing and over-toning will produce these defects.

A *yellow mottled effect* may arise from imperfect fixation caused by the hyposulphite bath being weak, or old, or the prints sticking together.

A *mottled granular effect* of red and grey spots, called mealiness, may arise from over-rapid toning, or from some defect in the paper.

A *dull heavy effect in the whites* of the picture may arise from the paper having been kept too long after exciting, or from looking at the progress of printing in daylight, or from toning or fixing in daylight.

The print being too red may arise from under-toning, from a used-up toning bath, or from some defect in the paper.

A variety of spots and stains may arise from dirty fingers and dirty vessels, or general want of care and cleanliness in manipulating.

LESSON FOURTH.

HOW TO PRODUCE LARGE PHOTOGRAPHS FROM SMALL ONES.

ONE of the greatest boons to the photographer with limited appliances is found in the methods of producing very perfect large photographs from small negatives. Without the use of large and costly apparatus, and extensive establishments, it is possible to produce pictures up to life-size. The photographer whose appliances are only suited to the production of carte-de-visite negatives may, by a comparatively slight addition to these appliances, acquire the power to produce fine large pictures of almost any dimensions he may desire. As the processes are as simple and easy as the apparatus is cheap and efficient, we may without impropriety introduce instructions in a book essentially intended for beginners.

There are various modes of enlargement, but they may be divided into two classes: one consists in producing an enlarged positive from the small negative, and the other consists in producing a large negative from the small negative, and printing copies from the large negative in the usual way. This work may be effected either by the aid of direct sunlight, diffused daylight, or artificial light. One of the best methods is by the aid of magnesium light, one of the most perfect and actinic of artificial lights. Its advantages are manifold: it does the work perfectly; it is economical, being ignited and put out in a moment; there can be no waste of either time or material; and it is clean and convenient. Mr. Solomon has devised an admirable lamp for using this light, and supplies

all the necessary appliances. Its use cannot be too strongly recommended.

TO PRODUCE AN ENLARGED POSITIVE BY MEANS OF MAGNESIUM LIGHT.

The apparatus necessary consists of a magnesium lamp and small enlarging camera; an upright screen, upon which the sheet of sensitive paper is placed during exposure; a clean piece of board the size of a sheet of photographic paper; and one or two large dishes.

The small negative ought to be as sharp and full of detail, and as free from blemish of every kind, as possible, as in the enlargement all defects are magnified. The small negative is placed in the groove in the enlarging camera, and an image of the proper size focussed on a sheet of white paper placed on the screen. The distance at which this screen must be placed will vary with the amount of enlargement and the focus of the lens used. If, for instance, from a one-inch head a six-inch head is required, and the lens employed have a focus of six inches, the distance of the screen from the lens will be six times and one-time the focus of the lens, making forty-two inches; and the distance of the negative from the lens will be one-sixth of the distance of the screen from the lens, which will be seven inches. When the camera is arranged, and a focus duly obtained on the screen, a sheet of prepared sensitive paper is placed on the screen whilst wet, and the magnesium ribbon lighted. The time of exposure will depend on many things, such as the amount of enlargement, the density of the negative, &c. After exposure the image is developed. Before proceeding to speak of the manipulations in detail, we will refer to the preparations to be employed.

Iodized Paper.—Paper ready for sensitizing is supplied by Mr. Solomon, and much trouble is saved by its use. For those wishful to prepare their own paper we subjoin the formula.

A good stout sample of photographic paper is used, and treated with the following :—

Iodide of potassium	...	...	...	80 grains
Bromide of ammonium	...	...	...	35 "
Chloride of ammonium	...	...	...	10 "
Gelatine	...	...	...	60 "
Albumen	...	...	...	1 ounce
Water (distilled)	...	...	...	10 ounces

Mix, and after the gelatine has become swollen and soft, apply heat to complete dissolution. This solution is usually applied to the paper with a clean sponge; but where the paper is intended for negatives, we imagine immersion would answer as well, inasmuch as it is not important to retain the image on the surface. The paper so prepared can be kept in a dry place ready for use. When required for producing a negative, it is excited by application of the following solution :—

Nitrate of silver	...	...	...	1 ounce
Glacial acetic acid	...	...	...	$\frac{1}{2}$ "
Water (distilled)	...	...	...	12 ounces

The paper is laid on a perfectly flat board, upon which a sheet of clean blotting-paper has been placed first. The board must be about half-an-inch each way less than the sheet of paper, the edges of which are turned over and fastened to the edge of the board with drawing-pins. A little of the silver solution is then poured on the middle of the sheet of paper, and a perfectly clean tuft of cotton wool, having been made into something like a ball without loose fibre projecting, is used to spread the solution all over the surface, spreading the solution gently about until the paper lies flat and damp without wrinkling or cockling. It is then ready for exposure whilst wet.

The enlarging camera and magnesium light have already been placed in readiness for use, as we have described, and an

image of the transparency the size required focussed on a sheet of white paper placed on the moveable screen. The wet sensitive paper is now placed on the screen, and the magnesium ribbon lighted. An exposure of about two minutes, consuming something like three pennyworth of the magnesium, is sufficient for an enlargement of six times.

The exposure being completed, the paper is again placed on the board, and a developing solution, prepared as follows, applied:—

Gallic acid	...	...	...	...	60 grains
Acetate of lead	...	...	...	...	10 „
Distilled water	...	...	...	...	10 ounces

Filter before use. In cold weather apply warm. The developer is applied in the same manner, and with the same piece of cotton wool as was used for sensitizing the paper. The trace of silver solution left in the wool is of much service, and by a little skill in manipulating, applying the wool frequently in one place, portions apparently developing slowly can be forced, or parts requiring more vigour somewhat intensified. After rinsing, the print is fixed in hyposulphite of soda, one ounce in six ounces of water, and then well washed.

Until the operator has some experience as to the requisite time of exposure, the following method of procedure may be of service to him:—After having sensitized the paper, pour over the developer; let it remain about one minute, then place the paper in position; expose for a short time, and, on examination by candle light, the picture will be seen slowly to develop itself. This is advantageous, inasmuch as if the first exposure has been insufficient, it may be repeated. When the details are out, the picture may be taken down and strengthened by a second application of the developer, if necessary.

TO PRODUCE AN ENLARGED NEGATIVE.

If, instead of a negative, a transparency be placed in the enlarging camera, and similar manipulations be employed, the result will be an enlarged paper negative from which as many enlarged prints as may be desired can be produced. The transparency should be very fully exposed and very fully developed. It should be sharp and full of detail. The exposure of the paper and the development with gallic acid should be carried a little further than is necessary for a positive print. After completion and drying it can, if necessary, be retouched. It is then made transparent by saturation with melted white wax.

In like manner an enlarged negative on a collodion plate can be produced, the manipulations being similar; similar solutions being used as are employed in the ordinary wet process. In either case a transparency of the same size as the negative is first required. A transparency for exhibiting in the magic lantern, and giving a rapid idea of the effect which an enlarged picture will give, may be produced as follows:—

Place the negative or positive on glass to be copied, backed up against a piece of ground glass; hang or fix it against the pane of the window, darkening just sufficiently around it that the image is brightly focussed on the screen of the camera; focus sharply, and proceed as described for the wet processes. The transparency required for producing an enlarged negative requires very special qualities, which we will describe under the next heading.

TRANSPARENT POSITIVES FOR ENLARGEMENT.

Assuming that a good small negative has been obtained (one which is sharp, delicate, and full of half-tone), the most important aid in securing a fine enlarged negative from it consists in a method of producing a good and suitable trans-

parent positive from it. A good transparent positive for this purpose differs in some essential respects from a good transparency for the stereoscope or magic lantern. Of the latter it is a good test that it shall look well as a picture when laid down on a piece of white paper, being very clear in the lights, and not over-loaded with deposit in the shadows. A first condition in the transparency for enlargement, after good definition, is, it should not be suitable for examination in the way described: its chief characteristic should be the possession of full detail and sufficient deposit in every part, without a trace of bare glass except in some minute points of extreme high light. Whilst it is important that the transparency should be covered with well-made-out detail, it is equally important that the deposit should be of the most delicate character, as free from texture and granulation as possible. The image of an ordinary collodion transparency developed with iron may, for instance, appear to the eye delicate and fine, but it will be found, when magnified in enlargement, to be coarse and unsatisfactory, the texture of the film and that of the deposit of silver as reduced by the iron developer presenting a rough, granular appearance, which will be very offensive in the print from the enlarged negative. This subject has received considerable attention of late, and the necessities of the case are much better understood by photographers than formerly; but how best to meet them still remains a question, the best methods having been kept secret. The formula we are about to lay before the reader has not been published before, and is one of the best in existence. The image, being obtained on the textureless film presented by albumen, is free from the objections which a simple collodion film presents, and the homogeneous character of the deposit of silver produced by pyrogallie acid development prevents anything like granulation, whilst its non-actinic colour gives

it especial value in securing sufficient vigour without over-intensification. By means of the following formula a transparency may be produced giving the utmost delicacy, modelling, and brilliancy, in the enlarged negative. The process, as will be seen, is a modification of the collodio-albumen process, and the plates are intended for contact printing. Take—

Albumen	12 ounces
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beat well, and allow to stand a few hours. Then add:

Water	2 drachms
Acetic acid	48 minims

Shake well, and filter. Then add:—

Water	...	...	...	...	12 drachms
Iodide of ammonia	...	...	...	...	72 grains
Bromide of ammonia	...	...	...	...	12 „
Ammonia forte	...	...	...	...	1 drachm

Take a powdery iodized collodion, and pour on a well cleaned piece of plate glass in the usual way, after which put it into water until all greasiness disappears, and wash well under the tap. Now pour on a small quantity of albumen to flow away the surface water on the collodion, and throw it away; then flow from the thumb and opposite side, fresh albumen, repeating this two or three times, taking care not to return the albumen in a wave back on the plate, or it will give a mark. When the albumen has flowed over the plate as described, put it up to dry, and when dry sensitize, rinse, dry, and pack away for use when wanted.

Sensitizer.

Water	...	...	...	...	12 ounces
Silver	...	...	...	...	1 ounce
Acetic acid	...	...	...	...	1 „

Sensitize in ordinary temperature one minute, or hot weather

forty seconds. When the plate is taken from the silver bath, slightly wash or rinse with distilled water, and put it on end or in one corner to dry. Expose under the negative for a few seconds to good daylight. Experience will be the best guide as to time of exposure, which will vary with the condition of the light and the opacity of the negative.

To develop, take—

Pyro	...	...	...	...	15 grains
Acetic acid	...	...	...	...	2 drachms
Water	...	...	...	...	8 ounces

In winter warm the developer.

If the exposure has been sufficient, a well modelled transparency covered with detail, but not over-loaded with deposit, will be secured. Fix with—

Hypo	...	...	...	...	6 ounces
Water	...	...	...	...	28 "

The transparency may, after washing and drying, be used in its present state, or its brilliancy may be increased by toning as follows:—Dissolve 15 grains gold in 2 ounces of water, and pour gradually the gold into the hypo, shaking it or stirring it whilst pouring in the gold.

To keep the hypo and gold fixing and toning bath clear and properly neutral, put in a nut of hard chalk. In winter warm the pyrogallie solution. If a bromo-iodized collodion be used as a substratum, a backing will be necessary to prevent halation. Burnt sienna finely ground in gum water will answer this purpose.

IODIZED WAXED PAPER FOR ENLARGED NEGATIVES AND LANDSCAPE WORK.

The iodized waxed paper process affords facilities for producing very fine enlarged negatives with the magnesium light, and is also excellent for landscape work. The iodized

paper is sold ready prepared by Mr. Solomon. To make it sensitive proceed as follows:—

In five ounces of distilled water dissolve 150 grains of nitrate of silver and three drachms of glacial acetic acid; filter this solution, then cut your waxed iodized paper the size required, seeing they are marked on the right side in the corner. Go into your dark room, and have two large dishes full of rain or river water, which will do if it is not convenient to get distilled, and have another dish for the nitrate bath; in that bath immerse the iodized waxed paper, taking care there are no air-bubbles, and let it remain five minutes, or until the paper becomes of a pale lemon colour; plunge it then into the first dish of water, then into the second; give it a good washing. You may know when it has had enough by its not appearing greasy, the water taking all over alike; then dry it between blotting, and pack it between dry blotting for use. This paper will keep sensitive and may be used in the camera for several days, particularly if kept from the air and light. Sensitive paper ready for use may be obtained of Mr. Solomon. The exposure should be from six to ten times as long as for wet collodion.

To develop, proceed as follows:—

In one pint of distilled water dissolve half-a-drachm of gallic acid; when dissolved, filter; then, in the dark room, plunge the negatives into this solution, taking care there are no air-bubbles; you may put as many as six in a dish. Then have another dish with gallic acid and a small quantity of aceto-nitrate solution, and, as the pictures appear in the first dish, take them out and plunge them into the second dish (even if they should not appear after ten minutes do the same). They will, if having had the right exposure, develop very rapidly. Push on the development, if they show signs of stopping, by a little more silver solution until the sky is quite

black. When developed, wash them well in plain water, and plunge them in a bath of hyposulphate of soda (three ounces to a pint); take them to the light for this operation. They are finished when the yellow is all out of the paper. Wash out all the hyposulphate of soda afterwards with plenty of water, and hang to dry; when dry, hold them to the fire until the wax melts all over the negative; it is then quite finished.

FINAL HINTS.

THESE brief lessons have given the student an insight into the general practice of photography; but there is much which cannot be included in so brief a space, and which will be found in more comprehensive manuals. A few final hints may be desirable. Be careful in every step, and especially cleanly. Wherever washing is directed, take care to wash thoroughly. Weigh and measure all the preparations carefully. Keep all the vessels, bottles, dishes, very clean, and each to its own use. Never use a vessel of any kind first for one solution and then another, as a very slight trace of one chemical will often spoil another by its contact. Filter all solutions when they are first made, and afterwards whenever they get turbid. Use clean plates and clean cloths. When you get into a difficulty, the exact cause of which is not apparent, proceed systematically to discover the cause, by testing each preparation used separately. Finally, read some of the photographic periodicals, from the pages of which you will gain constant accessions of information; and join a photographic society, by which you will be encouraged and aided in your study of this most fascinating art.

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